

## **PTR-1 Detox/Stabilization Technology....**

**PTR-1 Detox/STABILIZATION** is an in situ and ex situ detoxification and stabilization technology that utilizes the synergistic application of specific inorganic and organic reagents. Heavy metals in contaminated solids, such as soils, sludge, ash and sediments, are reduced to their lowest valence state and rendered insoluble as stable organometallic complexes. The detoxified and stabilized solids readily achieve the TCLP requirements and are no longer leachable. **PTR-1** technology can also be applied simultaneously with biological treatment (bioremediation) for the destruction of organic contaminants.

### **TECHNOLOGY HIGHLIGHTS:**

The key detoxification mechanism of this technology is the use of **PTR-1**. **PTR-1** is an organic sulfur polymer of the basic molecular formula: CS<sub>3</sub><sup>++</sup>. U.S. Patent No. 4943377, with additional U.S. and Foreign Patents Pending. The **PTR-1** agent, upon contact with metals and their compounds, will form metallic thiocarbonates/sulfides that, for all practical purposes, will not leach under either acidic (TCLP) or alkaline conditions. These stable compounds are neither hazardous nor toxic and, in fact, are similar to their common metallic forms in nature, which maintain and increase their stability over time. Since **PTR-1** is a liquid detoxifying reagent, contact with metal compounds is accomplished with minimal mixing, significantly reducing material handling costs when compared to traditional methodologies.

### **TECHNOLOGY/METHODOLOGY COMPARISONS:**

Traditional Portland Cement methodology provides a solution via two basic mechanisms. First, the volume of contaminated solid, such as soil, is significantly increased by the addition of stabilization additives. Thus-the TCLP will improve by dilution. Secondly, the stabilization additives encapsulate the heavy metals and compounds thus reducing their exposure to lixivants. The potential negative to utilizing such highly alkaline stabilizers on amphoteric metals is the likelihood of actually increasing the metal solubility under non-acidic (or typical groundwater) conditions.

Strip leaching metal contaminated soils using acetic/peroxide is effective BUT the process significantly increases the total volume of waste (spent leaching solution and rinse water) and usually requires final soil stabilization to achieve the required TCLP limit.

**PTR-1** technology does not rely on the use of Portland cement as a detoxifying reagent. At some sites, small amounts of Portland cement may be included in the treatment to impart beneficial physical characteristics, BUT the Portland cement is not used to "encapsulate" or otherwise hide the metals in an effort to achieve satisfactory TCLP results. When detoxifying soils in situ, the **PTR-1** reagents are simply percolated into the soil where they convert the heavy metals into a permanently stable, non-toxic form.

### **SOIL REMEDIATION:**

Heavy metal contaminated soil is typically the result of a spill or unintentional contamination with toxic heavy metals, or at times may result from an inadequately lined settling or storage pond. Ionic metals and certain soluble metal hydroxides will migrate from the contamination site. **PTR-1** will permanently insolubilize the metals to prevent migration and allow easy decontamination. In some cases, it may be possible to show that the site is fully stable and no further decontamination is necessary.

### **TECHNOLOGY COMPONENTS:**

PTR-1 technology typically requires the use of one or more of the following reagents to obtain the desired results.

- **PTR-1** is the key ingredient required to detoxify and render insoluble the metals in the soil. Often it is the only reagent required.
- When toxic metals in the soil are of a high valence state, such as hexavalent chromium, or some forms of arsenic, selenium and other multivalent metals, a reduction step is required prior to the addition of PTR-1. Reducing agents such as sodium metabisulfite or ferrous sulfate are commonly used.
- To assist in the formation of an insoluble matrix that prevents the migration of metal precipitates, coagulant-type reagents such as ferrous chloride, ferrous sulfate or anhydrous sodium metasilicate may be required.

### **TREATABILITY STUDIES:**

To determine the efficiency of the **PTR-1**, and whether or not other reagents are required, treatability studies are essential. In addition to metals, there are other components in the soil, ash, or other contaminated solids, which may react with the treatment reagents. The treatability studies will help determine how the **PTR-1** (and other reagents) reacts with all the components in the contaminated solid. A pilot in situ test or a lab bench test can be performed to determine the optimum selection of reagent(s) and dosage. When performing a treatability study, the reduction process may be the first step. Please note that in soil, the reduction reaction is not necessarily instantaneous. Generally, the lower the pH the shorter the reduction time. Some experimentation is required to obtain the optimum results.

### **STABILIZATION TECHNIQUE:**

1. To optimize **PTR-1** dosing, any high valence metals present in the soil must be reduced. Do not use oxidizing agents. Admix sodium metabisulfite, ferrous sulfate, or other inexpensive reducers, until ORP is in the negative millivolt range.
2. For better dosing control - dilute the **PTR-1** 1 to 1 or more with water.
3. Per uniform batch of soil, run an accelerated leach test to determine ppm of all leachable metals. **PTR-1** is not metal specific and will stabilize all metals.
4. Based on the gross ppm of metals - admix, surface spray or inject **PTR-1** based on the following formula: (The formula is for neat **PTR-1**, if using dilute, increase in proportion). **(ppm of all leachable metals) x (pounds of soil to be treated) x (0.2) = (Equals) Milliliters of THIO-RED required, 10%.**
5. Mix thoroughly at contamination site and draw representative sample for TCLP procedure. If leachable metals are in excess of limit - increase **PTR-1** dosing.
6. A migration plume may be intercepted and stabilized with injections of **PTR-1**.

### **COSTS:**

When utilizing **PTR-1** technology for soil remediation, treatment costs are typically one-third to one-half the cost of traditional methods. As a liquid detoxifying reagent, the application of **PTR-1** to soil (and other solids) is quite easy with little or no increase in volume. Contact between **PTR-1** and the metal compounds are accomplished with minimal mixing since **PTR-1** is a water-based product.

As a result, material handling costs are significantly reduced when using **PTR-1** in place of traditional methodologies. Likewise, since the application of **PTR-1** to the contaminated soil requires minimal dosing, the reagent costs are substantially less than other methodologies. In addition - the soil is actually detoxified as opposed to simply stabilized.

**PTR-1** is a sodium polythiocarbonate that converts ionic metals and soluble metal salts into metallic thiocarbonates/sulfides which are essentially nontoxic and totally insoluble

**PTR-1**, U.S. and Foreign Patents Issued and Pending.